(Continued from page 1, line 27 of the translation of the original PCT text)

The upper and lower runs are connected together by a curved region of the energy guide chain.

The energy guide chain known from the above-identified publication serves for receiving and guiding lines from a connection on the vehicle body to a connection on the lower holding arm of the sliding door in order to

supply electrical energy to various electric devices arranged in the sliding door such as for example an electric drive motor for the sliding door.

The system including the guide rail with the roller running therein and the guide device with the energy guide chain which is guided therein accordingly takes up a great deal of space in the region of the vehicle body, which adjoins the door opening. In particular there must be sufficient space between the guide rail and the door opening, for the guide device for the energy guide chain. Upon subsequent installation of the unit consisting of the guide device and the line receiving means therefore the available space may be problematical so that modifications are required to the vehicle body in the region in question.

Japanese Abstract 11093514 describes a sliding door system for a vehicle comprising a drive roller driven by an electric motor and a toothed belt circulating between the drive roller and further driven rollers. As the toothed belt is connected by way of a traction arm to a carrier element for a roller, a sliding door is pulled and the vehicle opening is opened or closed. In the opening or closing movement of the door an electric feed cable is unwound from the roller against the spring force of a spiral spring or wound on to the roller. The electric feed cable unwound from the roller is not exposed outwardly as it is arranged in a lower rail.

Japanese Abstract 2002225644 describes a sliding door system for a vehicle having a coupling device which is arranged within a guide having a plurality of intermediate portions arranged between an end portion and a base end portion, which coupling device can be transferred from an elongate, slightly arcuate arrangement into a substantially U-shaped curved arrangement. Fixed to a roller fixing means secured to a sliding door is a deflection means which has a completely opened deflection guide portion and a completely closed deflection guide portion, which is in contact with the end of the guide of the coupling device both at the beginning of the opening movement of the door and at the beginning of the closing movement of the door in order to restrict the deflection of the guide means of the coupling device in the opposite direction.

The object of the present invention is to provide a sliding door system which is of a compact structure and which is suitable for subsequent installation of a line receiving means for energy supply to the sliding door.

According to the invention that object is attained by a sliding door system of the kind set forth in the opening part of this specification, having the features of claim 1.

By virtue of that measure the space required for the guide rail of the sliding door and the guide device for the line receiving means

(continued on page 2, line 21 of the translation of the original PCT text)

(Continued from page 5, line 25 of the translation of the original PCT text)

In a particularly desirable configuration the guide rail can be channel-shaped with an opening which extends in the longitudinal direction and through which the holding arm extends. In that structure the guide element can have at least one roller which is arranged in the channel-shaped guide rail rotatably about a substantially horizontal axis and which is mounted to the holding arm.

In a desirable configuration of the line receiving means it has an end member which is connected by way of a loop-shaped part to the guide

element or a part of the holding arm, which extends into the guide rail. Particularly in the case of a guide rail which is curved in the horizontal plane, the loop-shaped part on the end member and/or on the part of the holding arm which extends into the guide rail is mounted pivotably about a substantially vertical axis.

Preferably at least the region of the line receiving means, which is arranged adjacent to the guide element, or the entire region of the line receiving means, will move as far as the deflection region thereof directly in the track of the guide element. The guide rail for the guide element of the sliding door therefore does not have to be widened or practically not widened.

Provided at an end of the guide rail which is directed towards an end of the vehicle, that is to say towards the front of the vehicle or towards the tail of the vehicle, is a deflection region for the line receiving means, by which it is deflected through a given angle in a given direction when moving towards the end of the vehicle, while connected to the deflection region is a channel-shaped guide in which the deflected portion of the line receiving means extends as a first run, which is adjoined by a substantially semicircular arc of a predetermined radius and same is adjoined

(Continued on page 6, line 20 of the translation of the original PCT text)

(Continued from page 7, line 14 of the translation of the original PCT text)

In this respect the deflection device can be in the form of a separate part of the guide device and possibly spaced from adjacent regions thereof. Deflection can thus occur at the outwardly curved side of the line receiving means. By virtue of the free deflection effect, the entire arrangement is particularly compact, less susceptible to trouble and simple to maintain, and the line receiving means is simple to replace.

Deflection of the first run of the line receiving means at the end of the guide rail, which is directed towards an end of the vehicle, can take place for example through about 90° or through about between 120° and about 180°, in particular about 180°.

The curvature of the deflection of the first run of the line receiving means at the end of the guide rail, which is directed towards the end of the vehicle, and the substantially semicircular deflection of the line guide device between the first and second runs, with respect to the longitudinal extent of the line guide device, are in the same direction. The second run can thus be arranged in a region which is included between the two portions of the first run, wherein the two portions respectively adjoin the deflection.

The line receiving means which is guided substantially horizontally in adjacent relationship with the sliding door, in the deflection region, can occur in a substantially vertical direction, that is to say 'upwardly' or

'downwardly' with respect to the vehicle, or in a direction in opposite relationship to the direction of movement of the sliding door to be opened.

The channel-shaped guide can be formed in particular as an elongate, substantially parallelepipedic housing, in the end of which there is an opening for the deflected portion of the line receiving means to pass therethrough, and in which the respective outwardly facing sides of the run are guided at two oppositely disposed longitudinal sides.

(Continued on page 8, line 8 of the translation of the original PCT text)

CLAIMS

1. A sliding door system for a vehicle with a vehicle body having a door opening and a sliding door (3), comprising a guide rail (1; 30; 33) which can be mounted on or in the vehicle body in the proximity of the door opening, a guide element (2) which is displaceable along the guide rail (1; 30; 33) and which is connected to the sliding door (3) by way of a holding arm (5; 32; 34), a line receiving means (15) of pivotably interconnected members (16) for receiving and guiding electric lines (20) from a connection on the vehicle body to a connection at the sliding door (3), wherein the line receiving means (15) is guided in a guide device, characterised in that the guide device for the line receiving means (15) is integrated into the guide rail (1; 30; 33) for the guide element (2) of the sliding door (3), provided at an end of the guide rail or the guide device, which is directed towards an end of the vehicle, the front of the vehicle or the tail of the vehicle, is a deflection region for the line receiving means (15), by which it is deflected through a given angle in a given direction upon displacement in a direction towards the end of the vehicle, and connected to the deflection region is a channel-shaped guide in which the deflected portion of the line receiving means (15) extends as a first run (23) which is adjoined by a substantially semicircular arc (24) of a predetermined radius and adjoining which is a second run (25), the end of which is connected stationarily to the vehicle body, and the curvature of the deflection of the first run of the line receiving means (15) at the end of the guide rail or the guide device, which is directed towards an end of the vehicle, and the substantially semicircular deflection of the line guide means (15) between the first and second runs are in the same direction with respect to the longitudinal extent of the line guide means (15).

2. A sliding door system as set forth in claim 1 characterised in that the guide rail (1; 30) is arranged externally on or in the vehicle body in the region over which the sliding door (3) is moved when being opened and

closed, and the holding arm (5; 32) is arranged in the rear end region of the sliding door (3), which is directed towards the tail of the vehicle.

3. A sliding door system as set forth in claim 1 characterised in that the guide rail (33) is arranged on or in the lower region of the vehicle body along the door opening and the holding arm (34) is arranged at the front end region of the sliding door (3), which is directed towards the front of the vehicle.

4. A sliding door system as set forth in claim 1 characterised in that the guide rail is arranged on or in the upper region of the vehicle body along the door opening and the holding arm is arranged at the front end region of the sliding door.

5. A sliding door system as set forth in one of claims 1 through 4 characterised in that the holding arm (5; 32; 34) has two arm portions which are connected together pivotably about a substantially vertical axis or is mounted pivotably to the sliding door (3).

6. A sliding door system as set forth in one of claims 1 through 5 characterised in that in its front end region which is directed towards the front of the vehicle the guide rail (30, 33) has a substantially horizontally extending curved region (31, 35).

7. A sliding door system as set forth in one of claims 1 through 6 characterised in that an end of the line receiving means (15) is connected to the guide element (2) by way of a connecting element.

8. A sliding door system as set forth in claim 6 and claim 7 characterised in that the connecting element is pivotable with respect to the guide element (2) about a substantially perpendicular axis.

9. A sliding door system as set forth in one of claims 1 through 8 characterised in that the electric lines (20) issuing from an end of the line receiving means are passed by way of the holding arm (5; 32, 34) to the sliding door (3).

10. A sliding door system as set forth in one of claims 1 through 9 characterised in that the guide rail (1; 30, 33) is of a channel-shaped configuration with an opening which extends in the longitudinal direction and through which the holding arm (5, 32, 34) extends, and the guide element (2) has at least one roller (11) which is arranged in the channel-shaped guide rail (1; 30; 33) rotatably about a substantially horizontal axis and is mounted to the holding arm (5; 32; 34).

11. A sliding door system as set forth in claim 8 and claim 10 characterised in that the line receiving means (15) has an end member (17) which is connected by way of a loop-shaped portion to a part of the holding arm (32; 34) which extends into the guide rail (30; 33), and the loop-shaped portion is mounted pivotably about a substantially vertical axis at the end member (17) and/or at the part of the holding arm (32; 34) which extends into the guide rail (30; 33).

12. A sliding door system as set forth in one of claims 1 through 11 characterised in that the deflection region for the line receiving means (15) is provided at the rear end, which is directed towards the tail of the vehicle, of the guide rail or the guide device, by which it is deflected through a given angle in a given direction upon displacement in a direction towards the tail of the vehicle.

13. A sliding door system as set forth in claim 1 through 12 characterised in that the means for deflection of the line receiving means (15) is the end of the guide rail, which is directed towards an end of the vehicle, or a channel-like or housing-like region (21a) of the guide device.

14. A sliding door system as set forth in one of claims 1 through 13 characterised in that deflection of the first run of the line receiving means (15) at the end of the guide rail or the guide device, which is directed towards an end of the vehicle, is through about 90° or through about 120° to about 180°.

15. A sliding door system as set forth in one of claims 1 through 14 characterised in that the line receiving means (15) which is guided substantially horizontally in adjacent relationship with the sliding door is effected in the deflection region into a substantially vertical direction or into a direction opposite to the direction of movement of the sliding door which is to be opened.

16. A sliding door system as set forth in one of claims 1 through 15 characterised in that the channel-shaped guide is in the form of an elongate substantially parallelepipedic guide housing (22), in the one end of which there is provided an opening for the passage therethrough of the deflected portion of the line receiving means (15) and in which the respective outwardly facing sides of the runs (23, 25) are guided at two oppositely disposed longitudinal sides.

17. A sliding door system as set forth in one of claims 1 through 16 characterised in that the channel-shaped guide is arranged in a pillar of the vehicle body.

18. A sliding door system as set forth in one of claims 1 through 17 characterised by a drive device for moving the sliding door (3) along the guide rail (1; 30; 33).

19. A sliding door system as set forth in claim 18 characterised in that the drive device has a reversible motor arranged in the vehicle body and a pulling device which is driven by the motor and which in the longitudinal direction of the guide rail (1; 30; 33) is connected to the guide

element (2) or the holding arm (5; 32; 34) and with which the guide element (2) or the holding arm (5; 32; 34) is displaceable along the guide rail (1; 30; 33) in both directions in dependence on the direction of rotation of the motor.

20. A sliding door system as set forth in claim 19 characterised in that the pulling means has two cable runs (28; 29) which are connected to a respective side of the guide element (2) or the holding arm (5; 32; 34) and which extend along the guide rail (1; 30; 33) and at the ends thereof are deflected to a drive unit which exerts a pulling force on one cable run (28, 29) or the other, in dependence on the direction of rotation of the motor.

21. A sliding door system as set forth in claim 20 characterised in that the pulling means is formed by a toothed belt drivable by the motor by way of a pinion.

22. A sliding door system as set forth in one of claims 18 through 21 characterised in that the drive device has a motor arranged in the sliding door (3), a pinion driven by the motor and arranged on the holding arm and a row of teeth meshing with the pinion and extending along the guide rail (1; 30; 33).

23. A sliding door system as set forth in one of claims 1 through 22 characterised in that, to guide the sliding door, at least one second guide rail (7) is arranged on the vehicle body in the upper and/or lower region along the door opening, with a second guide element (8) which is displaceable along the second guide rail (7) and which is connected by way of a second holding arm (9) to the front region of the sliding door (3), which is directed towards the front of the vehicle.

24. A sliding door system as set forth in one of claims 1 through 23 characterised in that the region (15a) of the line receiving means (15),

which is arranged in adjacent relationship with the guide element (2), is displaced directly in the track of the guide element (2).